UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|---|---|---|---|
| 10/519,084 | 12/23/2004 | Heiji Watanabe | Q85504 | 7332 |

23373 7590 06/15/2007

SUGHRUE MION, PLLC
2100 PENNSYLVANIA AVENUE, N.W.
SUITE 800
WASHINGTON, DC 20037

| EXAMINER | |
|---|---|
| CHIU, TSZ K | |

| ART UNIT | PAPER NUMBER |
|---|---|
| 2822 | |

| MAIL DATE | DELIVERY MODE |
|---|---|
| 06/15/2007 | PAPER |

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

| Office Action Summary | Application No. | Applicant(s) | |
|---|---|---|---|
| | 10/519,084 | WATANABE ET AL. | |
| | Examiner | Art Unit | |
| | Tsz K. Chiu | 2822 | |

*-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --*

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1)☒ Responsive to communication(s) filed on *26 March 2007*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

4)☒ Claim(s) *21-40* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *21-40* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

**Application Papers**

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *2/28/07*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

## DETAILED ACTION

### *Claim Rejections - 35 USC § 102*

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claim 21-24 and 26-40 are rejected under 35 U.S.C. 102(b) as being anticipated by Park et al. (7157359).

With respect to claim 21, Park discloses a semiconductor device stacked a gate insulating film (4,10, for example figure. 3c) and a gate electrode (5, for example figure. 3c) in this order on a silicon substrate (1, for example figure. 3c); wherein

said gate insulating film (4, for example figure. 3c) comprises a nitrogen containing high-dielectric-constant insulating film (Column 3, lines 39-46) which has a structure in which nitrogen is introduced into metal oxide or metal silicate; and

the nitrogen concentration in said nitrogen containing high-dielectric-constant insulating film (Column 3, lines 39-46) has a distribution in the direction of the film thickness; and a

position at which the nitrogen concentration in said nitrogen containing high-dielectric-constant insulating film (Column 3, lines 39-46) reaches a maximum in the direction of the film thickness is present in a region at a distance from the silicon substrate (1, for example figure. 3c).

With respect to claim 22, Park discloses a semiconductor device according to Claim 21, wherein a position at which the nitrogen concentration in said nitrogen containing high-dielectric-constant insulating film (4, for example figure. 3c) reaches a maximum in the direction of the film thickness is present in a region at a distance of not less than 0.5 nm (Column 3, lines 25-27) from the silicon substrate (1, for example figure. 3c).

With respect to claim 23-24, Park discloses a semiconductor device according to Claim 21, wherein a position at which the nitrogen concentration in said nitrogen containing high-dielectric-constant insulating film (4, for example figure. 3c) reaches a maximum in the direction of the film thickness (Column 3, lines 25-27) is localized on the side of a gate electrode (5, for example figure. 3c) in said nitrogen containing high-dielectric-constant insulating film.

With respect to claim 26,31, Park discloses a semiconductor device according to Claim 21, wherein said gate insulating film (4, for example figure. 3c) comprises a silicon oxide film (10, for example figure. 3c) formed on said silicon substrate so as to be in contact therewith, and said nitrogen containing high-dielectric-constant insulating film (Column 3, lines 39-46) formed on said silicon oxide film so as to be in contact therewith.

With respect to claim 27,32,35,38, Park discloses a semiconductor device according to Claim 21, wherein said silicon substrate (1, for example figure. 3c) and said gate insulating film (4, for example figure. 3c) are in contact with each other, and said gate insulating film (4, for example figure. 3c) and a gate electrode (5, for example

figure. 3c) are in contact with each other; and said gate electrode is made of either a polysilicon or a polysilicon germanium conductive film (Column 1, lines 17-20).

With respect to claim 28,33,36,39, Park discloses a semiconductor device according to Claim 21, wherein said gate insulating film contains at least one type selected from the group consisting of Zr, Hf, Ta, A1, Ti, Nb, Sc, Y, La, Ce, Pr, Nd, Sm, Eu, Gd, Tb. Dy, Ho, Er, Tm, Yb and Lu (Column 3, lines 32-36).

With respect to claim 29, Park discloses a semiconductor device stacked a gate insulating film (4, for example figure. 3c) and a gate electrode (5, for example figure. 3c) in this order on a silicon substrate (1, for example figure. 3c); wherein

said gate insulating film (4, for example figure. 3c) comprises a nitrogen containing high-dielectric-constant insulating film (Column 3, lines 39-46) which has a structure in which nitrogen is introduced into metal oxide or metal silicate; and

a nitrogen atom in said nitrogen containing high-dielectric-constant insulating film selectively bonds with a silicon atom in metal silicate (4, For example Fig. 3c).

With respect to claim 30, Park discloses a semiconductor device according to Claim 29, wherein a nitrogen atom which selectively bonds with a silicon atom in said metal silicate (4,5, For example Fig. 3c) is situated at a distance from the silicon substrate (1, For example Fig. 3c).

With respect to claim 34, Park discloses a semiconductor device stacked a gate insulating film (4, for example figure. 3c) and a gate electrode (5, for example figure. 3c) in this order on a silicon substrate (1, for example figure. 3c); wherein

said gate insulating film (4, for example figure. 3c) comprises a nitrogen containing high-dielectric-constant insulating film (Column 3, lines 39-46) which has a structure in which nitrogen is introduced into metal oxide or metal silicate; and

the composition of said nitrogen containing high-dielectric-constant insulating film continuously varies in the direction of the film thickness and the silicon concentration has a minimum value in the middle section lying between a silicon substrate (1, for example figure. 3c) side interface of said nitrogen containing high-dielectric-constant insulating film and a gate electrode (5, for example figure. 3c) side interface thereof; and

nitrogen is introduced only into a region lying between the position at which the silicon concentration has the minimum value and said gate electrode side interface.

With respect to claim 37, Park discloses a semiconductor device stacked a gate insulating film (4, for example figure. 3c) and a gate electrode (5, for example figure. 3c) in this order on a silicon substrate (1, for example figure. 3c); wherein

said gate insulating film (4, for example figure. 3c) has a layered structure having, from the silicon substrate side (1, for example figure. 3c), a first silicon oxide film (3, for example figure. 3c), a metal oxide film or a metal silicate film (5, for example figure. 3c) and a second silicon oxide film (6, for example figure. 3c); and

only the second silicon oxide film (6, for example figure. 3c) has a structure in which nitrogen is introduced into silicon oxide (Column 3, lines 39-46).

With respect to claim 40, Park discloses a semiconductor device stacked a gate insulating film (4, for example figure. 3c) and a gate electrode (5, for example figure. 3c) in this order on a silicon substrate (1, for example figure. 3c); wherein

said gate insulating film (4, for example figure. 3c) contains nitrogen and metal oxide or metal silicate (10, for example figure. 3c); and

the nitrogen concentration in said gate insulating film (Column 3, lines 39-46) has a distribution in the direction of the film thickness; and

a position at which the nitrogen concentration in said gate insulating film (4, for example figure. 3c) reaches a maximum in the direction of the film thickness is present in a region at a distance from the silicon substrate (1, for example figure. 3c).

***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claim 25 is rejected under 35 U.S.C. 103(a) as being unpatentable over Park et al. (7157359).

With respect to claim 25, Park discloses a semiconductor device according to Claim 21, wherein the nitrogen concentration on a silicon substrate (1, for example figure. 3c) side interface of said gate insulating film (4, for example figure. 3c) is less than 3 atomic %.

Park did not discloses the insulating film is less than 3 atomic %, however, atomic range would have been obvious to an ordinary artisan practicing the invention because, absent evidence of disclosure of criticality for the range giving unexpected results, it is not inventive to discover optimal or workable ranges by routine

experimentation. Furthermore, the specification contains no disclosure of either the critical nature of the claimed dimensions of any unexpected results arising therefrom. Where patentability is aid to be based upon particular chosen dimensions or upon another variable recited in a claim, the applicant must show that the chosen dimensions are critical.

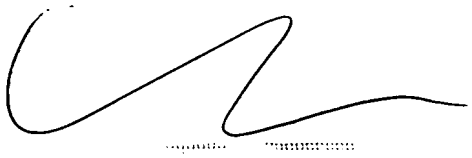
Any inquiry concerning this communication or earlier communications from the examiner should be directed to Tsz K. Chiu whose telephone number is 571-272-8656. The examiner can normally be reached on 0800 to 1700.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Zandra V. Smith can be reached on 571-272-2429. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

TC

June 11, 2007



Mary Wilczewski
Primary Examiner